APPENDIX
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Improving *National Transportation Statistics:* Airline Safety as a Case Study

The annual *National Transportation Statistics (NTS)* report published by BTS is a reference publication that compiles a large number of transportation data series in a single, regularly updated volume. Each year's report contains a profile of financial, operating, and safety characteristics of each transportation mode—highway, rail, air, etc. Each year's compendium also has sections on such topics as safety, with tables and graphs for all of the transportation modes. Most tables and graphs provide time series of data in 5-year or 10-year intervals for the past 2 or 3 decades, with annual data for the most recent 3 to 4 years. (As in the *Statistical Abstract of the United States*, which annually provides a large number of tables on a broad range of subjects, there is no analytical commentary in the *NTS* reports.)

Although bringing together a large amount of data in a convenient form, the usefulness of the *NTS* reports as reference documents is affected by the scarcity of explanatory notes, including those that would describe important changes in definitions of variables across time (see Chapter 3). Also lacking are explanations that would help users understand the extent to which it is appropriate to compare data series on particular topics across transportation modes. Finally, the graphs and charts that are included are not always helpful or appropriate. (The most recent *1997 NTS* report includes more tables than previous reports and eliminates all charts and graphs.)

We reviewed the tables and graphs on airline safety from the *1996 NTS* as a case study to identify some of the problems with the *NTS* reports and ways in which BTS could improve them, topic by topic, over the next few years. The publication is valuable; our goal in the case study was to identify areas for improvement. The *1997 NTS*—which became available to the panel only after its

work was finished—reflects improvements that anticipate many of our comments; further improvements can be made, particularly in providing more detailed explanatory notes. (BTS is completing a review of the *1997 NTS* to this end.) Below we present an abbreviated version of our case study from the *1996 NTS*.

REVIEW OF 1996 NTS AIRLINE SAFETY STATISTICS: CONCLUSIONS

The commentary below addresses selected tables and graphs on airline safety from the *1996 NTS*, with suggestions for changes that could help the user make appropriate comparisons over time and across transportation modes or categories of a mode. For airlines, categories include major U.S. air carriers, commuter carriers, on-demand air taxis, and general aviation. The commentary makes a number of main points:

- There are no graphs of accident and fatality rates across airline categories that provide data on a comparable basis.
- There are no tables or graphs that break down the components of underlying trends (e.g., growth in aircraft passenger-miles as a function of the number of flights, distance per flight, and number of passengers per flight) or that draw out their implications for safety trends.
- Tables on the same topic do not always contain comparable data, and there is inadequate warning to users when this occurs.
- Graphs are provided for raw counts (e.g., numbers of accidents or fatalities, sometimes with different scales), when such numbers are likely misleading in the absence of information about exposure (i.e., when the counts are not converted to rates by the use of appropriate denominators—a point that is made in the BTS *Transportation Statistics Annual Reports*).
- Although sources are cited, there is no information provided about the underlying data systems or the quality of the data.

REVIEW OF 1996 NTS AIRLINE SAFETY STATISTICS: COMMENTARY

Air Carrier Profile

The profile section provides numbers of accidents, fatal accidents, and fatalities for scheduled and nonscheduled airlines operating under 14 CFR 121 and for scheduled commuter airlines and nonscheduled on-demand air taxis operating under 14 CFR 35. (CFR, which stands for the *Code of Federal Regulations*, is nowhere defined.) The profile also provides performance data on aircraft revenue-miles, aircraft revenue-hours, revenue passenger-miles, and revenue passenger emplanements, which could serve as denominators with which to compute

accident and fatality rates. However, the performance data are provided for different categories of airlines than are the safety data (e.g., majors, nationals, large regionals), and there is no explanation of how the categories in the performance and safety portions of the profile relate, or if indeed they can be related.

Safety Section

Table 28—Fatalities, Injuries, and Accidents by Mode

The data in Table 28 for U.S. air carriers, commuter air carriers, and on-demand air taxis match the data in the profile; however, the Table 28 definition of air carriers is "large" carriers operating under 14 CFR 121, which implies something different from all carriers operating under that set of regulations. Citations are provided in a separate section; no information is provided about any of the major data sources or how they might compare across transportation modes.

Figure 9—Fatalities by Transportation Mode, 1960-1994

Figure 9 provides two bar graphs, each showing trends for 4 transportation modes. Two modes are omitted entirely: motor vehicle traffic and rail-highway grade crossings. The two graphs differ in scale on the vertical axis, which means that the reader may incorrectly infer that waterborne transport in the 1970s (bottom graph) was considerably more hazardous than, say, general aviation in the same time period (top graph). The use of the same scale on the horizontal axis for single years from 1990 to 1994 as for 5-year intervals from 1960 to 1990 in this and other graphs may mislead the reader about time trends.

A more useful presentation could be to have a set of line graphs for all of the modes with appropriate time intervals and a common vertical scale, with a break in the scale at the top for motor vehicle traffic. However, there is a real question as to the value of graphing the number of fatalities (or accidents) at all, given differences in the exposure of the population to risk.

Table 30 and Figure 11—U.S. Air Carrier Accident and Fatal Accident Rates per Million Aircraft Miles Flown

The data on millions of aircraft miles flown in Table 30 cannot be related to the profile.

Figure 11 provides two graphs, one on trends in millions of aircraft-miles flown and another on accident and fatal accident rates per million miles flown. It could be useful to provide text explaining that changes in aircraft-miles flown are a function of changes in the number of takeoffs (flights) and changes in the distance flown per flight. If data exist on these components, it could be useful to show them together with the trends in total aircraft-miles flown. It could also be

useful to show accident and fatal accident rates per 100,000 takeoffs, as in Table 36 for commuter air carriers, and to explain briefly when one denominator might be more appropriate to use than another.

Table 31 and Figure 12—U.S. Air Carrier Passenger Fatality Rates per 100 Million Passenger-Miles

The data on fatalities in Table 31 are for scheduled service only and so do not match the data in Table 28. The data on fatalities can be matched to the data in the profile, but not so the data on revenue passenger-miles.

Figure 12 contains three graphs—for trends in revenue passenger-miles, number of fatalities, and the passenger fatality rate. The usefulness of the graph on number of fatalities, given that the vertical scale is so greatly different from that of the other graphs and that there is no measure of risk exposure, is open to question (the data are available in Table 31). Text could usefully be added to explain that trends in passenger-miles are a function of trends in three factors: number of takeoffs (flights), distance per flight, and number of passengers per flight. If data exist on these components, it could be useful to show them, as well as to show fatality rates for other denominators (e.g., 100,000 passengers) and briefly explain when one denominator might be more appropriate to use than another.

Table 32 and Figure 13—U.S. Air Carrier Accidents and Serious Injuries

Figure 13 graphs numbers of accidents and serious injuries, which do not appear to be useful to show in graphical form, given the absence of denominators.

Table 36—Commuter Air Carrier Accidents, Fatalities, Injuries, and Accident Rates

Table 36 provides accident and fatal accident rates per million aircraft-miles flown and per 100,000 departures. No rates are given for fatalities, and no graphs are shown. It could be useful to show graphs that compare accident and fatality rates for U.S. air carriers and commuter air carriers on a common basis, if this is possible.

Table 37—On-Demand Air Taxi Accidents, Fatalities, Injuries, and Accident Rates

Table 37 provides accident and fatal accident rates per 100,000 aircraft hours flown. No rates are given for fatalities, and no graphs are shown. It would be useful if accident and fatality rates could be compared for on-demand air taxis and other aviation modes (e.g., commuter airlines) on a common basis. If no data exist for this purpose, it would be useful to point out this fact.

Table 38 and Figure 16—General Aviation Accidents, Fatalities, Serious Injuries, and Fatal Accidents; Table 39 and Figure 17—General Aviation Fatality and Accident Rates per 100,000 Aircraft-Hours

Figure 16 provides numbers but not rates; its usefulness is open to question. Table 39 and Figure 17 provide rates for one denominator—aircraft-hours flown. Presumably other rates could be calculated on the basis of the information in the general aviation profile, which provides information on vehicle-miles and passenger-miles as well as aircraft-hours flown. However, the profile estimates of hours flown do not always agree with the estimates in Table 39. If possible, it would be useful to provide graphs that compare accident and fatality rates for general aviation with the other aviation modes.